General Construction and Access Description

Construction of transmission lines require pre-construction field surveying, site preparation, construction (i.e., installation of new structures, removal of existing structures), demobilization, and property restoration, which are performed following a relatively standardized sequence.

In general, construction activities include the installation of new structures, removal of existing structures, and property restoration. PSE aims to avoid or minimize impacts where practicable through project design considerations (*e.g.*, pole types and access routes). Along some route segments, PSE has easement rights that outline access agreements for the purpose of maintaining PSE's existing facilities and/or accessing PSE's right-of-way (ROW) for construction. Depending upon the segments chosen for the preferred route option, PSE plans to exercise these rights and, if necessary, acquire additional rights for construction of the project. To the extent possible, PSE uses existing or acquires new easement rights to provide access necessary to maintain and/or construct facilities.

1. Typical Construction Sequencing

Construction of a transmission line typically occurs in the following sequence:

1) Pre-construction surveying
    a. Conducting environmental surveys and obtaining geotechnical data by conducting soil borings
    b. Identifying pole locations
    c. Surveying, including right of way and boundary and structure locations (i.e., footings, underground utilities)
2) Site preparation
    a. Staking the ROW and critical areas, and pole locations
    b. Installing temporary erosion control measures
    c. If necessary, constructing access routes to the pole sites and developing installation sites
    d. Brushing, trimming and clearing of vegetation on the ROW to ensure the safe operation of the line
3) Construction
    a. Installing pole foundations or auger hole for direct embedment
    b. Assembling and erecting the poles
    c. Stringing the conductor and wires
    d. Removing existing structures, if necessary
4) Demobilization and clean up
5) Restoration and re-planting vegetation

The general process for the various types of poles being proposed are essentially the same, except for poles with engineered foundations (*e.g.,* drilled piers), which require additional steps.

The subsequent sections describe specific construction activities in further detail.

2. Pre-construction - Identifying Pole Locations

The placement, or "spotting," of poles depends upon factors such as available ROW width, location of access routes, topography, and obstacle avoidance. In turn, the height, loading, foundation type, and overall size of each structure will be greatly affected by the location of the structures.

The process for the spotting of poles is as follows:

- PSE will work with individual landowners to adjust pole locations where practicable to reduce impacts for the landowners.
- Proposed pole locations discussed with landowners will represent where poles are generally expected to be located, pending geographical and site-specific environmental review following city or county approval of a route. Unforeseen subsurface obstacles, such as geologic erratics, can cause a pole to be moved up or down the corridor (typically less than 20 feet).

In general, PSE considers the following factors when locating poles:

- **Technical considerations**, including electrical clearances, severe terrain accommodations, structural loading, manufacturability of structures, constructability of the line, and code requirements.
- **Critical Areas (*e.g.*, wetlands and streams)** so as to locate poles outside of critical areas and their buffers to the extent possible.
- **Electrical effects** to maintain additional buffers or install mitigation measures when co-located with other facilities (*e.g.*, pipelines).
- **Landowner considerations** by moving poles farther away from residences and/or locating poles on property lines and edges of tree lines.
- **Cost** to provide a cost efficient and feasible design within set parameters.

To reduce the environmental impacts of pole locations, where practicable, PSE will:

- Place new poles in approximately the same location of the existing poles;
- Locate poles near existing accessible routes to minimize construction traffic impacts;
- Avoid placing poles in areas that require significant access disturbance;
- Avoid environmental features by making small adjustments in the route and through careful structure placement; and
- Avoid critical areas unless another constraint forces a pole into such areas.

3. Site Preparation

3.1 Vegetation Management

Using the existing transmission line ROW is one of PSE's preferred routing criteria, as the vegetation in such corridors is already maintained to some degree. This includes selective removal of problem trees from beneath power lines or removal of hazardous trees that may fall into the electrical system as part of regular maintenance on all power line ROW. Proper pruning and discriminating use of growth regulators and herbicides are also among the methods employed. The method selected is dependent upon factors such as location, property use, and access. Growth regulators and herbicides are not commonly used in urban environments.

Emphasis is placed on removal of large, problem-tree species, especially in the case of those that have disease or insect infestation that can result in irreversible decline. Tree removal is especially important where pruning alone cannot achieve safe clearance from power lines.

Trimming, natural pruning techniques, or directional trimming will be used if proper line clearances can be achieved. Directional trimming concentrates on removing limbs and branches where the tree would normally shed them and direct future growth out and away from the electrical wires. While a newly pruned tree might look different to some, natural pruning is designed to protect the health of the tree. It minimizes re-growth and reduces trimming costs.

Directional trimming is the recommended method of the International Society of Arboriculture (ISA), American National Standards Institute (ANSI), and the National Arbor Day Foundation.

Both tree removal and natural pruning will be performed by specially trained contract crews. Upon completing of tree work, the crews will clean up the site and any wood that is cut will be left on site in pieces of manageable size at the property owner's request.

3.1.1 Guidelines for 230 KV Lines

Vegetation within a utility corridor that has transmission line(s) with an operational voltage of more than 200 kV must be managed in compliance with federal requirements. The fines/penalties associated with having a power outage caused by vegetation can be substantial. To ensure compliance with the North American Electric Reliability Corporation (NERC) standard, PSE allows vegetation with a mature height of no greater than 15 feet within the wire zone. For evaluation purposes, the same vegetation requirement was applied to the managed ROW zone. The area outside of the managed ROW, but still within the legal ROW, is subject to select clearing of trees that pose a risk of damaging the line.

The wire zone is the area measured 10 feet away from the outermost conductor(s) in a static position, whereas the managed ROW zone is the area that extends roughly 16 feet from the outside of the transmission wires in their static position.

The vegetation impact assessment used GIS analysis to evaluate the tree inventory data and the preliminary transmission line design to assess the number of trees that would likely require removal within a specific route. The steps of the analysis are provided below.

3.1.2 Guidelines for 115 kV Lines

Some of the alternatives for the Energize Eastside project include rebuilding or relocating 115 kV lines. NERC vegetation standards do not apply to PSE's 115 kV transmission or distribution line rights-of-way; however, in general, PSE will remove trees that mature at a height of greater than 25 feet near 115 kV lines. It should be noted that, some trees within the corridor or along roadways with a height of greater than 25 feet, may be allowed to remain in the wire zone if they can be pruned in a manner that allows sufficient clearance from the lines.

3.2 Access

Use of existing access routes is preferred as that is typically the best way to minimize impacts. When a project entails replacement of an existing transmission line, such as Energize Eastside, efforts are made to identify the existing or historic access routes. During initial construction of the transmission line, access routes are established along the corridor. As an area develops and structures are built along the corridor, some of the original access points are no longer viable and new ones need to be established to replace or maintain existing transmission line equipment.

Access to each structure location is identified in the field with a preference to those areas that require the least amount of improvement (*e.g.*, use of existing roads or trails). The field identified access routes are mapped using hand held GPS units. The GPS data is imported into the surveyed route maps for reference. Each route will be assessed on site with the affected property owners to gather site specific limitations and if necessary, identify improvement and restoration details.

Along the corridor, the access and pole locations are identified by the land surveyor and engineering team. As necessary, the access to each pole location is improved or created.

3.3 Utility Locates and Civil Work

As required by state law, utility locates are performed prior to ground disturbing activities. Appropriate temporary erosion control measures may be installed prior to and during work activities. Initial vegetation management activities then commence, removing those species that

are incompatible with the safe operation of the transmission line. If civil work is required to establish either a temporary or permanent construction area, that work typically takes place following vegetation removal.

A work area with an approximate radius of 50-feet around the new pole location would be typical. This area would provide a safe working space for placing equipment, vehicles, and materials.

4. Construction

PSE will work to restore property impacted by construction to its previous or an improved state, as practical and required under applicable law. PSE will mitigate in-kind when restoration is not possible, as required by applicable law. PSE will comply with local codes related to construction noise. PSE will work with property owners to minimize impacts during construction as much as practicable.

4.1 Pole Installation

Each steel pole will be installed either by direct embedment or placed on a drilled pier foundation. The type of foundation that will be used to support the poles will be dependent upon the structural loading, structural strength of the soil, and site accessibility. In areas near co-located underground utilities, such as the Olympic pipelines, the proposed pole location is reviewed in the field with BP, the pipeline operator. As appropriate, BP's general construction procedures will be followed when construction activities are to take place in the area of the Olympic pipelines.

The hole for the transmission pole is typically initiated using a vactor truck, which is one of the least invasive methods of excavation. If soil conditions allow, the entire hole could be excavated using a vactor truck; however, it may be necessary to use traditional auger equipment to achieve the necessary depth. Typical hole diameter is approximately 18-inches greater than the diameter of the base of the pole. Generally, the depth of the hole will be 10 percent of the pole height plus 2 feet.

In areas of soft soils, a steel casing may be used during drilling to hold the excavation open, after which the steel casing would be cut below grade and backfilled upon completion.

For direct embed poles, the base section of the pole is installed in the hole and the annulus filled with select backfill. When backfill must be imported, material is obtained from commercial sources.

For poles that require drilled pier foundations, the hole is advanced in the same manner as that for the direct embed poles. Reinforced-steel anchor bolt cages are then installed in the excavation. These cages are inserted in the holes prior to pouring concrete and are designed to strengthen the structural integrity of the foundations and are delivered to the structure site via flatbed truck. The excavated holes containing the reinforcing anchor bolt cages would be filled with concrete and be left to cure for 28 days.

To construct the actual steel structure, two methods of assembly can be used, the first of which is to assemble the poles, braces, cross arms, hardware, and insulators on the ground. A crane is then used to set the fully framed structure by placing the poles in the excavated holes or on the drilled pier foundation. Alternatively, aerial framing can be used by setting the first pole section in the ground or on the foundation, and subsequently adding the remaining sections and equipment via a crane.

4.2 Stringing

Installation of the conductor, shield wire, and communication fiber on the transmission line support structures is called stringing. The first step of wire stringing would be to install insulators (if not already installed on the structures during ground assembly) and stringing pulleys, which are temporarily attached to the lower portion of the insulators at each transmission line support structure to allow conductors to be pulled along the line. When an existing transmission line is being replaced, the new poles will be installed and the existing wires would be transferred to them from the existing poles that will be removed. This is done so that the existing conductor can be used to pull in the new conductor in a more efficient manner.

Once the existing conductors have been transferred to the stringing sheaves, they would be attached to the new conductors and used to pull them through the sheaves into their final location. Pulling the lines may be accomplished by attaching them to a specialized wire stringing vehicle. Following the initial stringing operation, pulling and sagging of the line would be required to achieve the correct tension of the transmission lines between support structures. After the new lines have been set, the existing poles are then removed.

Pulling and tensioning sites are expected to be required approximately every 2 miles along the corridor. Equipment at sites required for pulling and tensioning activities would include tractors and trailers with spooled reels that hold the conductors and trucks with the tensioning equipment. To the extent practicable, pulling and tensioning sites would be located within the existing corridor.

Depending on topography, minor grading may be required at some sites to create level pads for equipment. Finally, the tension and sag of conductors and wires would be fine-tuned, stringing sheaves would be removed, and the conductors would be permanently attached to the insulators at the support structures.

4.3 Demobilization and Restoration

Construction sites, staging areas, material storage yards, and access roads would be kept in an orderly condition throughout the construction period. Disturbed areas not required for access roads and maintenance areas around structures would be restored and revegetated, as agreed to with the property owner or land management agency.